Geophysical Research Abstracts
Vol. 19, EGU2017-8685, 2017
EGU General Assembly 2017

Shallow tillage generates higher N2O emissions: results of continuous chamber-based measurement in a winter wheat field.

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Agriculture is one of the most important contributors to GHG emission, notably through fertilized croplands. Though, few publications have studied simultaneously and through continuous measurement the N2O and CO_2 emissions in cultivated lands. We conducted this study to assess the effect of farming practices and climate on both N2O and CO_2 emissions from a winter wheat crop. The experiment was held in an experimental field in the loamy region in Belgium from March 2016 till crop harvest in August 2016. The fluxes were measured on two nearby parcels in a winter wheat field with restitution of the residues from previous crop. For the past 8 years, one parcel was subjected to a shallow tillage (ST, 10 cm depth) and the other one to a conventional tillage (CT, 25 cm depth).

On each parcel, the emissions are assessed with homemade automated closed chambers. Measurement continuity and good temporal resolution (one mean flux every 4 hours) of the system allowed a fine detection and quantification of the emission peaks which usually represent the major part of N2O fluxes. In addition to gas fluxes, soil water content and temperature were measured continuously. Soil samples were taken regularly to determine soil pH, soil organic carbon and nitrogen pools (total, NO_3- and NH4+) and study microbial diversity and nitrification/denitrification gene expression.

Unexpectedly, results showed N2O emissions twice as large in the ST parcel as in the CT parcel. On the contrary, less important CO_2 emissions were observed under ST. Several emission peaks of N2O were observed during the measurement period. The peaks occurred after fertilization events and seemed to be triggered by an elevation of soil water content. Interesting links could be made between soil NH4-N and NO_3-N pools and N2O emissions. Nitrification being the main process originating the fluxes was suggested on the one hand by the temporal evolution of nitrogen pools and N2O emissions and on the other hand by the relation between spatial variability of the emissions with the soil nitrate content. A comparison of the emissions between ST and CT and a discussion on peaks temporal dynamic, focusing on their intensity, duration and starting time will be presented.